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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/724,817

11/24/2003

Lars Risbo

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01/14/2008

TEXAS INSTRUMENTS INCORPORATED

P O BOX 655474, M/S 3999

DALLAS, TX 75265

EXAMINER

GHULAMALI, QUTBUDDIN

ART UNIT

PAPER NUMBER

2611

NOTIFICATION DATE

DELIVERY MODE

01/14/2008

ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

uspto@ti.com

uspto@dlemail.itg.ti.com

Office Action Summary

Application No.

10/724,817

Applicant(s)

RISBO ET AL.

Examiner

QUTBUDDIN GHULAMALI

Art Unit

2611

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 03 October 2007.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-31 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 21-26 is/are allowed.
- 6) ☒ Claim(s) 1-7, 9-20, 27-31 is/are rejected.
- 7) ☒ Claim(s) 8 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

1. This Office Action is responsive to the Remarks/Amendment filed 10/03/2007.

Response to Arguments

2. Applicant's remarks/arguments, see page 9, filed 10/3/2007, with respect to the rejection(s) of claim(s) 1, 13 and 14 under 35 U.S.C 102(e) have been fully considered and are persuasive. Therefore, the rejection has been withdrawn. However, upon further consideration, a new ground(s) of rejection is made in view of newly found art. The rejection based on the new art follows.

Claim Objections

3. Claim 2 is objected to because of the following informalities: In claim 2, last line ends with "and." It is not clear what the intent of the applicant is regarding "and" because limitation remains uncertain. Appropriate correction is required.

Claim Rejections - 35 USC § 102

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

5. Claims 1-4, 9-15, 18-20 and 29-31 are rejected under 35 U.S.C. 102(e) as being anticipated by Thompson (USP 5,028,924).

Regarding claim 1, Thompson discloses a compensation system programmed and/or configured to mitigate errors in conversion comprising: a digital error model (page 3, lines 5-11) configured to provide an emulated error signal as a function of an function of an input signal that is quantized in a predetermined number of one or more levels, the digital error model having parameters adaptively adjusted based on a signal of the conversion system to emulate (produce) error characteristics associated with at least a portion of the conversion system (A/D conversion system) (page 3, lines 20-47; col. 4, lines 25-40).

Regarding claim 2, Thompson discloses a compensation system programmed and/or configured to mitigate errors in conversion comprising: a digital error model (page 3, lines 5-11) configured to provide an emulated error signal as a function of an function of an input signal that is quantized in a predetermined number of one or more levels, the digital error model having parameters digitally adjusted based on in-band frequency content (quantization error) of a signal of the conversion system to emulate (produce) error

characteristics associated with at least a portion of the conversion system (A/D conversion system) (page 3, lines 20-47; col. 4, lines 25-40).

Regarding claim 3, Thompson discloses the signal of the conversion system is an output signal provided by the conversion system (the A/D converter responsive to a signal provides a digital signal representative of the input signal) (col. 3, lines 20-27).

Regarding claim 4, Thompson discloses a compensation system programmed and/or configured to mitigate errors in conversion comprising: a digital error model (page 3, lines 5-11) configured to provide an emulated error signal as a function of an function of an input signal that is quantized in a predetermined number of one or more levels, the digital error model having parameters adaptively adjusted based on a signal of the conversion system to emulate (produce) error characteristics associated with at least a portion of the conversion system (A/D conversion system) (col. 3, lines 20-47; col. 4, lines 25-40), and the parameters of the digital error model being adapted to converge to respective values that substantially minimize errors in an output signal of the conversion system over a plurality of iterations (the first and second digital output signals include quantization errors resulting from component mismatches between stages of sigma delta modulators the comb filter includes first and second integrators that allow convergence to minimize errors (compensates for the mismatch reducing quantization errors) (col. 3, lines 30-45).

Regarding claim 9, Thompson discloses a compensation system programmed and/or configured to mitigate errors in conversion comprising:

a digital error model (page 3, lines 5-11) configured to provide an emulated error signal as a function of an input signal that is quantized in a predetermined number of one or more levels, the digital error model having parameters adaptively adjusted based on a signal of the conversion system to emulate (produce) error characteristics associated with at least a portion of the conversion system (A/D conversion system) (page 3, lines 20-47; col. 4, lines 25-40); and a calibration system that calibrates the parameters of the digital error model in a calibration mode based on content of an output signal of the conversion system in response to a calibration signal provided to the conversion system (col. 2, lines 65-68; col. 10, lines 60-68; col. 11, lines 1-15).

Regarding claim 10, Thompson discloses estimator (digital differentiators 28, 30, 32) operative to minimize error in the output signal by adjusting the parameters of the digital error model based on at least one of the input signal and the output signal of the conversion system (abstract; col. 4, lines 25-48).

Regarding claim 11, the process to better approximate error on the conversion system as disclosed in Thompson is inherently implied (see abstract; col. 4, lines 44-59).

Regarding claim 12, Thompson discloses comb filter provide filtering output signal of the conversion system to provide residual error signal substantially free of out-band frequencies (col. 4, lines 52-59).

Regarding claim 13, Thompson discloses all limitations of the claim above. Thompson further discloses a DAC (58) coupled to receive the input signal that is quantized in the predetermined number of levels and to convert the input signal

to a corresponding analog output signal, the error characteristics being error characteristics associated with the DAC (col. 4, lines 60-68; col. 5, lines 1-10).

Regarding claim 14, Thompson discloses a noise and error shaping filter (comb filter 15) that receives a digital signal and provides a filtered digital signal (34) for conversion into the corresponding analog signal;

A quantizer (A/D converter) that provides a quantized signal to DAC (21) based on filtered digital signal, and provide emulated error signal shaping module (comb filter) as a function of quantized signal (col. 4, lines 50-59; col. 5, lines 1-10).

Regarding claim 15, Thompson discloses a compensation system programmed and/or configured to mitigate errors in conversion comprising: a digital error model (page 3, lines 5-11) configured to provide an emulated error signal as a function of an function of an input signal that is quantized in a predetermined number of one or more levels, the digital error model having parameters adaptively adjusted based on a signal of the conversion system to emulate (produce) error characteristics associated with at least a portion of the conversion system (A/D conversion system) (page 3, lines 20-47; col. 4, lines 25-40); a DAC (58) coupled to receive the input signal that is quantized in the predetermined number of levels and to convert the input signal to a corresponding analog output signal, the error characteristics being error characteristics associated with the DAC (col. 4, lines 60-68; col. 5, lines 1-10); and a calibration system that calibrates the parameters of the digital error model in a calibration mode based on content of an output signal of the conversion

system in response to a calibration signal provided to the conversion system (col. 2, lines 65-68; col. 10, lines 60-68; col. 11, lines 1-15).

Regarding claim 18, Thompson discloses a compensation system programmed and/or configured to mitigate errors in conversion comprising: a digital error model (page 3, lines 5-11) configured to provide an emulated error signal as a function of an function of an input signal that is quantized in a predetermined number of one or more levels, the digital error model having parameters adaptively adjusted based on a signal of the conversion system to emulate (produce) error characteristics associated with at least a portion of the conversion system (A/D conversion system) (page 3, lines 20-47; col. 4, lines 25-40); a DAC (58); A noise shaping filter as claimed, is ordinarily employed prior to introducing signal to the A/D converter so that error in signal can be minimized and limit the frequency band so that the A/D can handle the conversion efficiently; an A/D converter that converts the filtered analog signal (col. 4, lines 6-24); a DAC (58) coupled to receive the input signal that is quantized in the predetermined number of levels and to convert the input signal to a corresponding analog output signal, the error characteristics being error characteristics associated with the DAC (col. 4, lines 60-68; col. 5, lines 1-10); a calibration system that calibrates the parameters of the digital error model in a calibration mode based on content of an output signal of the conversion system in response to a calibration signal provided to the conversion system (col. 2, lines 65-68; col. 10, lines 60-68; col. 11, lines 1-15).

Regarding claims 19 and 20, Thompson discloses comb filter provide filtering output signal of the conversion system to provide residual error signal substantially free of out-band frequencies (col. 4, lines 52-59); a calibration system that calibrates the parameters of the digital error model in a calibration mode based on content of an output signal of the conversion system in response to a calibration signal provided to the conversion system (col. 2, lines 65-68; col. 10, lines 60-68; col. 11, lines 1-15).

Regarding claim 27-28, the step claimed as system is nothing more than restating the function of the specific components of the apparatus as claimed above and therefore, it would have been obvious to a person of ordinary skill in the art at the time the invention was made to utilize the steps to arrive at a system in converting an input signal, considering the aforementioned rejection for the apparatus claim 1.

Regarding claim 29, Thompson discloses a method for generating an error model operative to mitigate errors associated with at least a portion of a conversion system comprising:
supplying a calibration signal to the conversion system (col. 4, lines 5-24; col. 10, lines 35-68; col. 11, lines 1-15, 65-68; col. 12, lines 1-22);
providing an emulated error signal to the conversion system as a function of an intermediate signal generated based on the calibration signal and having a predetermined number of levels (quantized levels of converted analog signal) (col. 11, lines 30-45); adaptively calibrating parameters of the model based on an output signal of the conversion system to minimize error in the output signal,

which error is associated with at least a portion of the conversion system (; and storing the model when sufficiently calibrated (col. 3, lines 5-11, lines 20-47; col. 4, lines 25-40).

Regarding claims 30 and 31, Thompson discloses, a DAC (58) coupled to receive the input signal that is quantized in the predetermined number of levels and to convert the input signal to a corresponding analog output signal, the error characteristics being error characteristics associated with the DAC (col. 4, lines 60-68; col. 5, lines 1-10);

a calibration system that calibrates the parameters of the digital error model in a calibration mode based on content of an output signal of the conversion system in response to a calibration signal provided to the conversion system (col. 2, lines 65-68; col. 10, lines 60-68; col. 11, lines 1-15).

Claim Rejections - 35 USC § 103

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

7. Claims 5, 6, 7 are rejected under 35 U.S.C. 103(a) as being unpatentable over Thompson (USP 5,028,924) in view of Endres et al (US Pub. 2004/0190649).

Regarding claims 5-7, Thompson discloses a compensation system programmed and/or configured to mitigate errors in conversion comprising: a digital error model (page 3, lines 5-11) configured to provide an emulated error signal as a function of an function of an input signal that is quantized in a predetermined number of one or more levels, the digital error model having parameters adaptively adjusted based on a signal of the conversion system to emulate (produce) error characteristics associated with at least a portion of the conversion system (A/D conversion system) (page 3, lines 20-47; col. 4, lines 25-40). Thompson does not explicitly disclose a splitter to divide the input signal into a plurality of intermediate signals and a multi input single output (multiplexer) to combine the intermediate signals for providing the emulated error signal. However, Endres discloses a splitter operative to divide the input signal into plural intermediate signals (page 12, section 0179) ; and a multi-input single output system (multiplexer 910) that employs the parameters of the digital error model to combine the intermediate signals for providing the emulated error signal (page 12, section 0179). It would have been obvious to a person of ordinary skill in the art at the time the invention was made to use a splitter to split the signal and use a multiplexer to multiplex the plurality of intermediate split signals to combine to produce an error signal as taught by Endres in the system of Thompson because it can effectively provide or create an error signal for compensation of the input signal minimize error in the overall output signal.

8. Claims 16-17 are rejected under 35 U.S.C. 103 (a) as being unpatentable over Thompson (USP 5,028,924) in view of Sooch et al (USP 5,061,925).

Regarding claim 16, Thompson discloses a compensation system programmed and/or configured to mitigate errors in conversion comprising: a digital error model (page 3, lines 5-11) configured to provide an emulated error signal as a function of an input signal that is quantized in a predetermined number of one or more levels, the digital error model having parameters adaptively adjusted based on a signal of the conversion system to emulate (produce) error characteristics associated with at least a portion of the conversion system (A/D conversion system) (page 3, lines 20-47; col. 4, lines 25-40); a DAC (58) coupled to receive the input signal that is quantized in the predetermined number of levels and to convert the input signal to a corresponding analog output signal, the error characteristics being error characteristics associated with the DAC (col. 4, lines 60-68; col. 5, lines 1-10); a calibration system that calibrates the parameters of the digital error model in a calibration mode based on content of an output signal of the conversion system in response to a calibration signal provided to the conversion system (col. 2, lines 65-68; col. 10, lines 60-68; col. 11, lines 1-15). Thompson does not explicitly disclose an analog filter to remove out of band frequencies and quantize signal from corresponding analog output filtered signal. However, Sooch in a similar field of endeavor discloses DAC (21) coupled to receive the input signal that is quantized in the predetermined number of levels and coupled to an analog filter (22) to remove out of band frequencies and quantize signal from

corresponding analog output filtered signal (col. 3, lines 20-45). It would have been obvious to a person of ordinary skill in the art at the time the invention was made to use an analog filter to filter the input signal as taught by Sooch in the system of Thompson because it can effectively remove out of band frequencies from the converted signal from the DAC.

Regarding claim 17, Thompson discloses a compensation system programmed and/or configured to mitigate errors in conversion comprising: a digital error model (page 3, lines 5-11) configured to provide an emulated error signal as a function of an input signal that is quantized in a predetermined number of one or more levels, the digital error model having parameters adaptively adjusted based on a signal of the conversion system to emulate (produce) error characteristics associated with at least a portion of the conversion system (A/D conversion system) (page 3, lines 20-47; col. 4, lines 25-40); a DAC (58) coupled to receive the input signal that is quantized in the predetermined number of levels and to convert the input signal to a corresponding analog output signal, the error characteristics being error characteristics associated with the DAC (col. 4, lines 60-68; col. 5, lines 1-10); a calibration system that calibrates the parameters of the digital error model in a calibration mode based on content of an output signal of the conversion system in response to a calibration signal provided to the conversion system (col. 2, lines 65-68; col. 10, lines 60-68; col. 11, lines 1-15). Thompson does not disclose DAC include at least two capacitors. However, Sooch discloses a plurality of capacitors (fig. 4, switched capacitor stages 110, 112, 114 and 116) (col. 6, lines

46-68; col. 7, lines 1-18). It would have been obvious to a person of ordinary skill in the art at the time the invention was made to use capacitors as taught by Sooch in the system of Thompson because it can provide effective mitigation in error with the digital error signals.

Allowable Subject Matter

9. Claims 21-26 allowed.
10. Claim 8 is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Conclusion

11. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Qutbuddin Ghulamali whose telephone number is (571)-272-3014. The examiner can normally be reached on Monday-Friday, 7:00AM - 4:30PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Chieh M. Fan can be reached on (571) 272-3042. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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QG.
January 6, 2008.


CHIEH M. FAN
SUPERVISORY PATENT EXAMINER